2012

Toward the integration of visual languages for systemic design

Jones, Peter

Toward the Integration of Visual Languages for Systemic Design

Peter Jones, PhD
OCAD University, Toronto

Jeremy Bowes
OCADU

… our thesis

Systemic thinking is better **expressed in design languages** than system formalisms.

Understanding of complex systems is enhanced for a wider variety of stakeholders.

Visual design languages offer significant potential for **social & service systems** design.

Generative bias as opposed to descriptive science

IMAGINATION IS EVERYTHING
OCAD U

why a design language for systems?…

design is changing …

Design thinking is extending beyond design outcomes, but is falling short of systems methods & toolkits.
Design approaches differ from systems in many respects:

- Successive approximations toward emerging goals
- Continuous interpretation by multiple perspectives
- Action-oriented, making artifacts & prototypes
- Visual representations, from sketching to blueprints

However we still lack good theory & practices of systemic design.

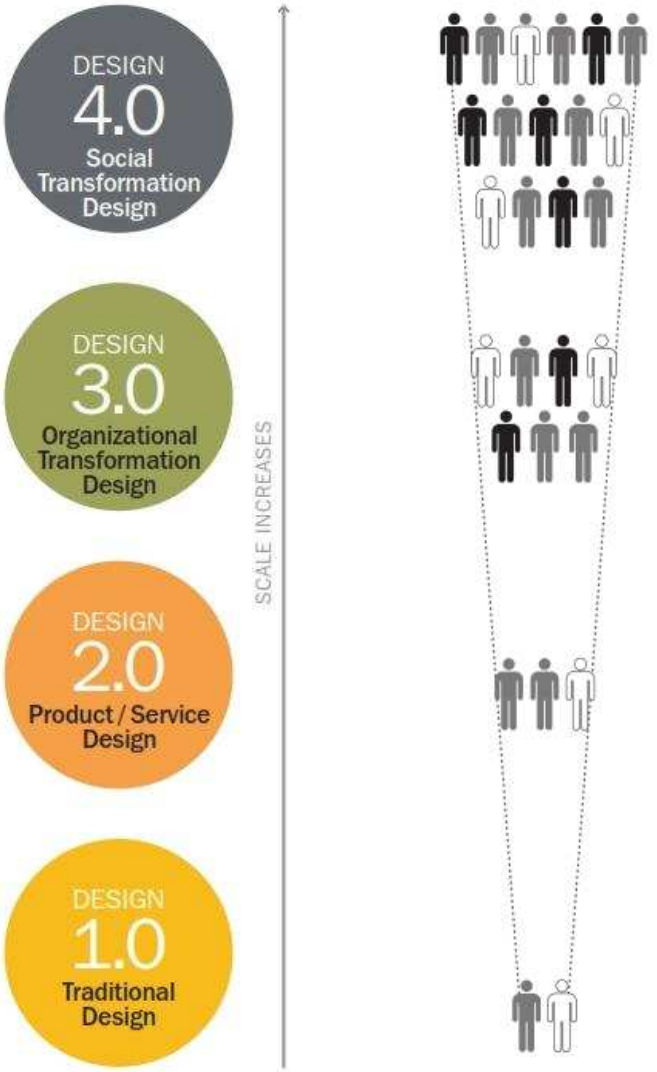
*…an opportunity for **COMPLEXITY NAVIGATION***

Design thinking also deals with **complexity**.

Design must become more **systemic** - as we are confronted with wicked problems.

Highly **complex domains need new methods**

Design 1.0	**Craft design, Advertising**
Design 2.0	**Industrial, Products, Web**
Design 3.0	**Organizational systems**
Design 4.0	**Social systems** **Mixed stakeholders**



don't we have good visual models in systems?

Warfield	Influence maps / directed graphs
Gharajedaghi	Context diagrams
Checkland	Soft Systems / Rich Pictures
Boardman	Systemigrams
System Dynamics	Causal loop diagrams
Robt Horn	Infographics

Recently?

what are the purposes of systems theory?

To understand *actual* systemic phenomena in complex systems?

To better communicate knowledge of systemic patterns affecting social & ecological outcomes?

To better organize sociotechnical systems?

Why not *innovation*, or to design significantly better systems for complex ?

why has Systems Thinking ignored Design?

Systems & Cybernetics grew from scientific disciplines.
Creative fields were not taken seriously.

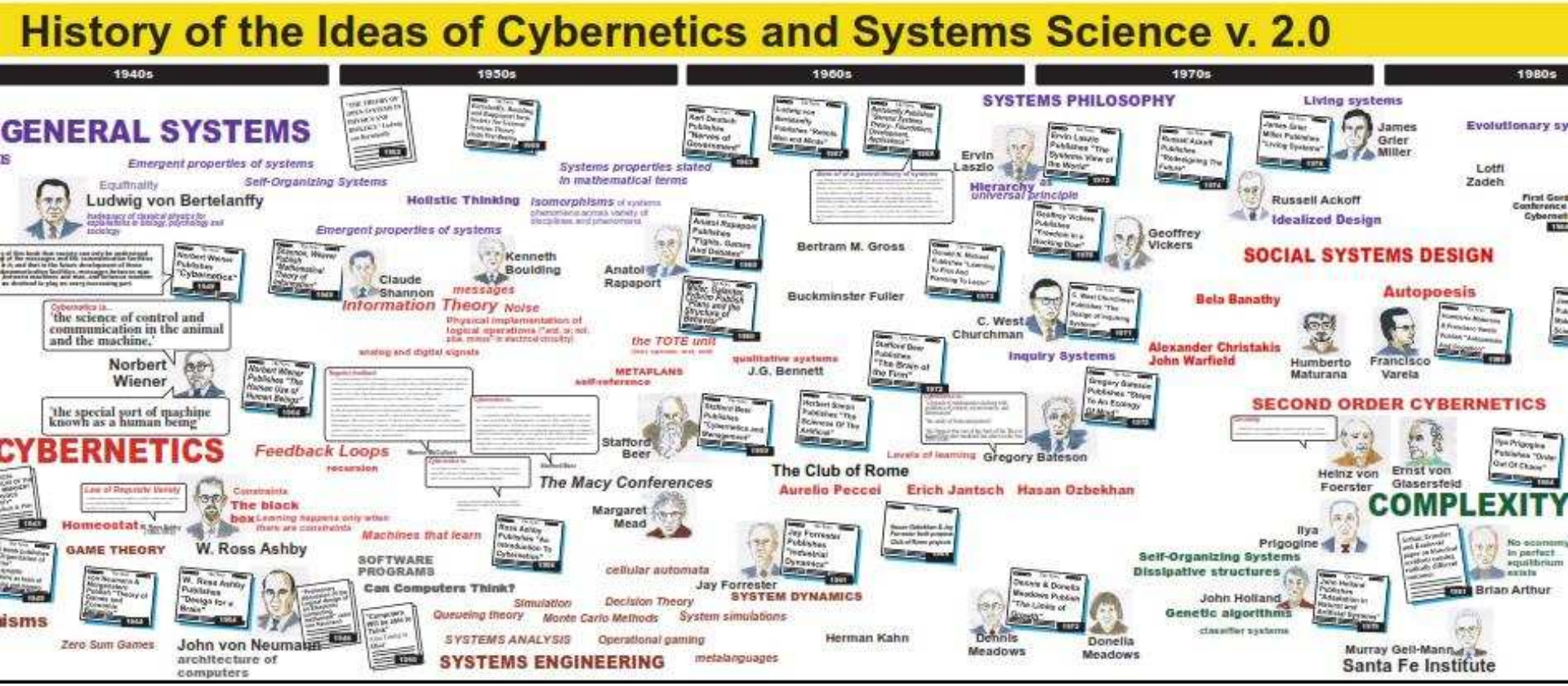
Systems theorists *redefined design* in *Design Science* terms.

Simon	**Design Science (Sciences of Artificial)**	
Fuller	**Comprehensive Design Science**	
Warfield	**Generic Design Science**	**(ISM)**
Christakis	**Dialogic Design Science**	**(SDD)**

By reframing design, cybernetics assumed it captured relevant processes.

Times change. Design has caught up to systems thinking.

WHICH FIT *WHERE* IN SYSTEMS LINEAGE?



Based on R. Horn, 2004, Adapted with permission.

*why has **Systems Thinking** ignored **Design?***

*"Though a handful design thinkers have made some substantial contributions to systems thinking in general, hardly anybody has developed a **systems practice from within design**, specially informed by design thinking and design practice. This is remarkable when we compare us with other fields where proprietary adaptations of systems perspectives are normal."*

Birger Sevaldson, Oslo School Of Architecture & Design
Giga-Mapping: Visualisation For Complexity & Systems Thinking In Design
Nordic Design Research Conference 2011

..the new approach to SOCIAL SYSTEMS DESIGN

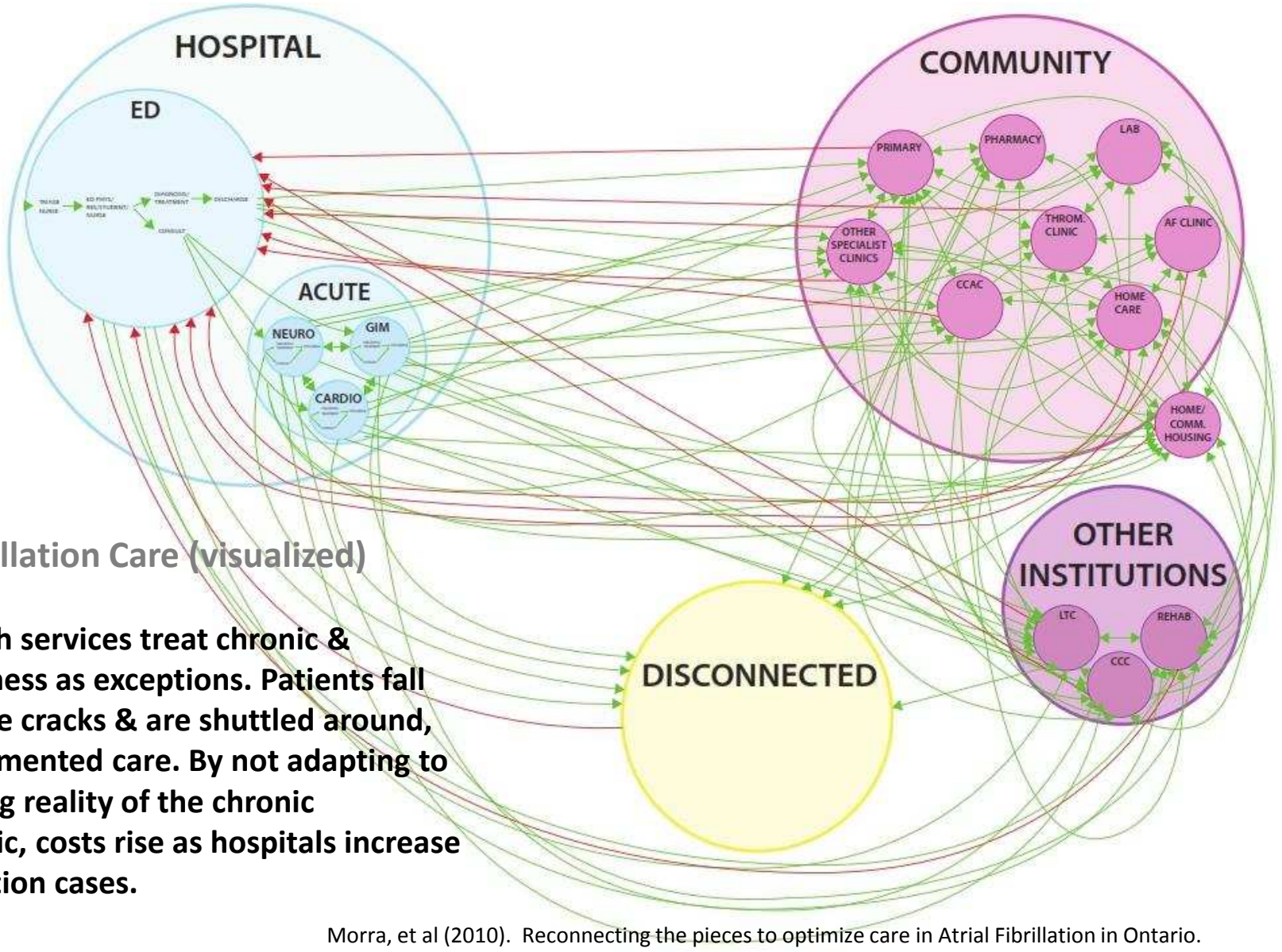
Service systems *are* social systems, as are:

Social innovations
Sustainable business models
Network organizations
Communities of practice
New learning institutions
Transparent markets
New (sustainable) economies
Emerging political structures

EXAMPLES

Design Thinking in HEALTHCARE SERVICES

..as services become MORE COMPLEX

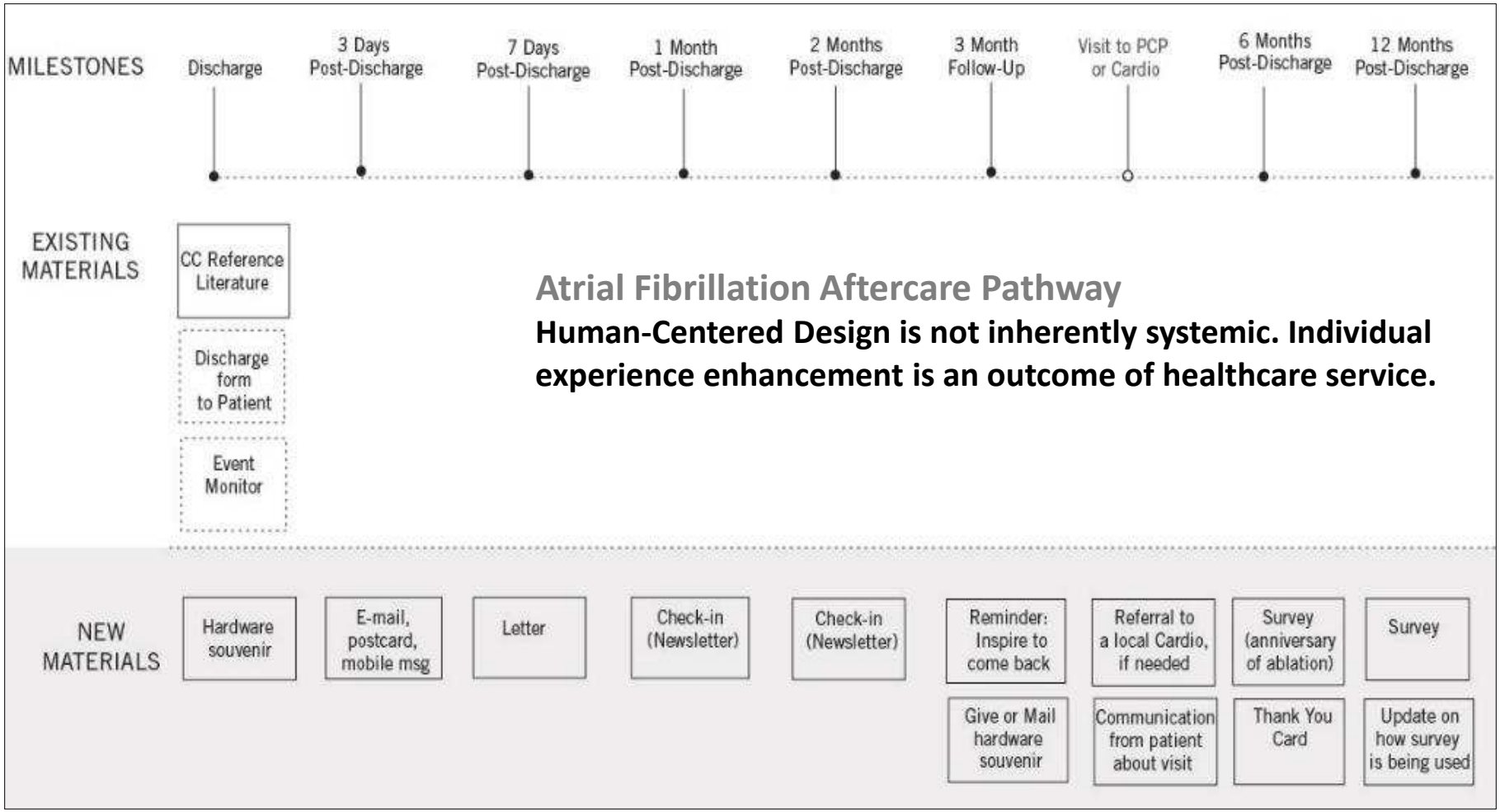


Atrial Fibrillation Care (visualized)

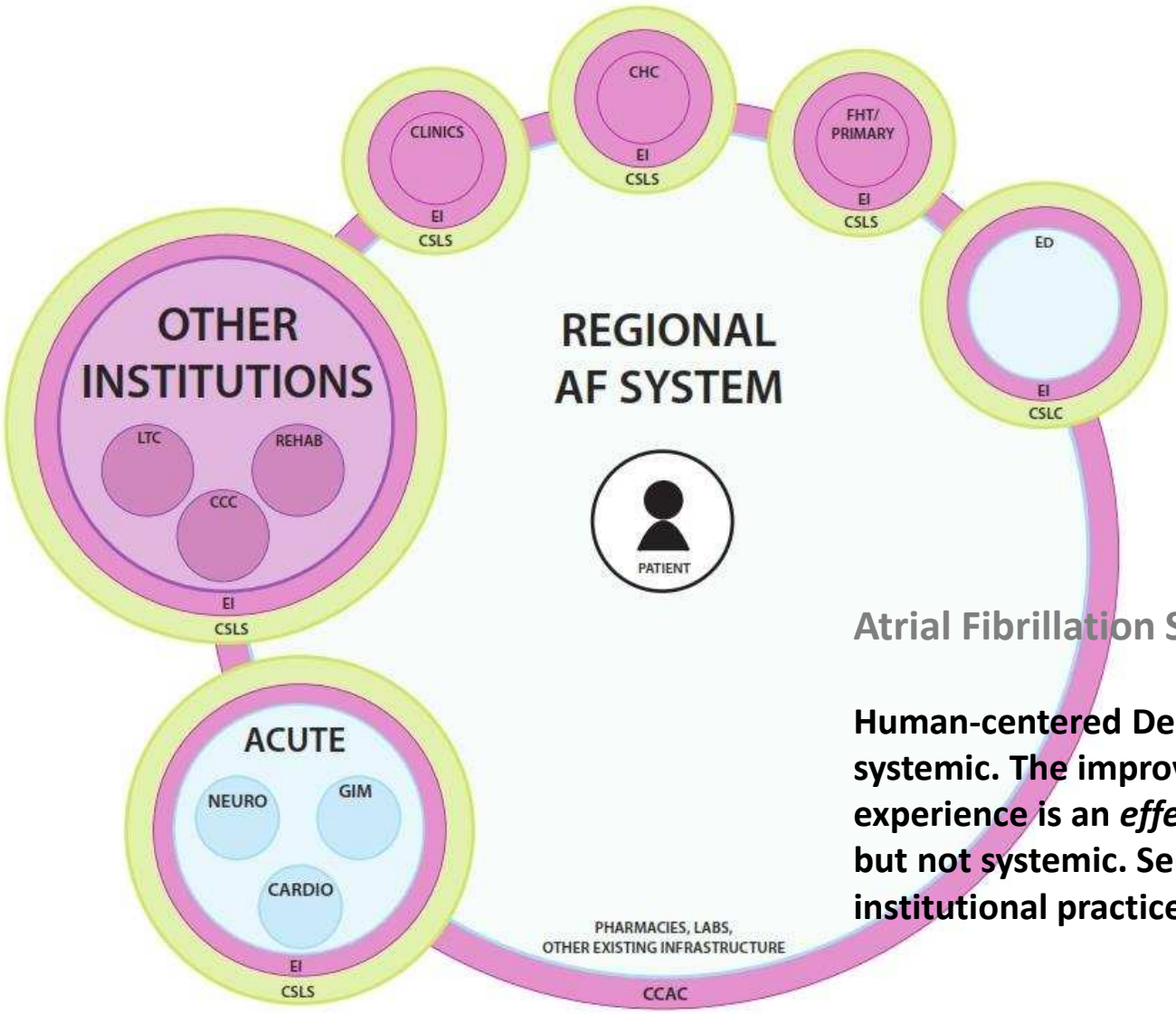
Many health services treat chronic & complex illness as exceptions. Patients fall between the cracks & are shuttled around, getting fragmented care. By not adapting to the changing reality of the chronic demographic, costs rise as hospitals increase their exception cases.

Morra, et al (2010). Reconnecting the pieces to optimize care in Atrial Fibrillation in Ontario.

HUMAN-CENTERED SERVICE DESIGN *is insufficient*



DESIGN ATTEMPTS at VISUALIZATION are insufficient



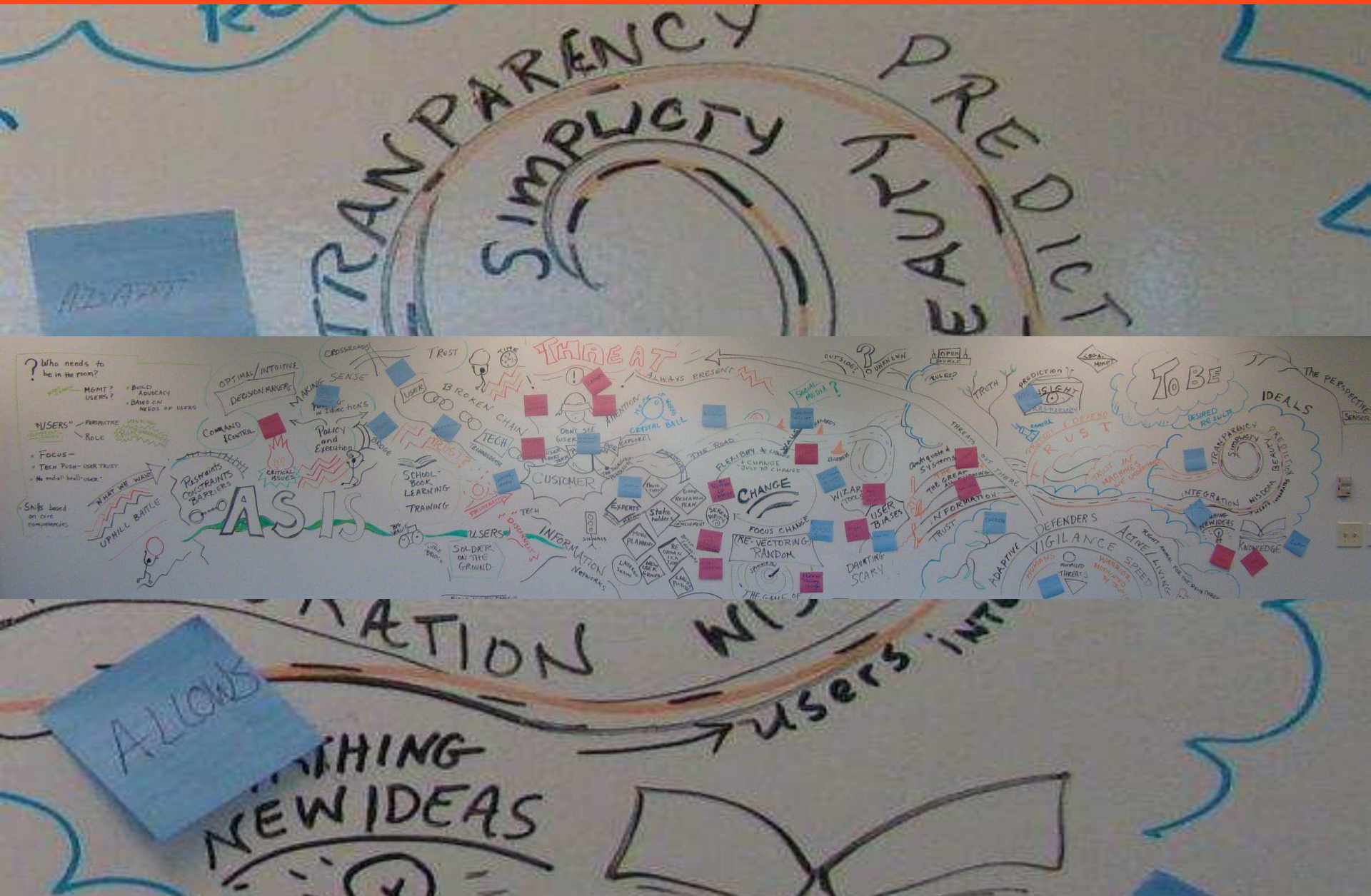
Atrial Fibrillation System Redesign

Human-centered Design is not inherently systemic. The improvement of individual experience is an *effect* in healthcare. Nice but not systemic. Service systems reinvent institutional practices & business models.

Morra, et al (2010). Reconnecting the pieces to optimize care in Atrial Fibrillation in Ontario.

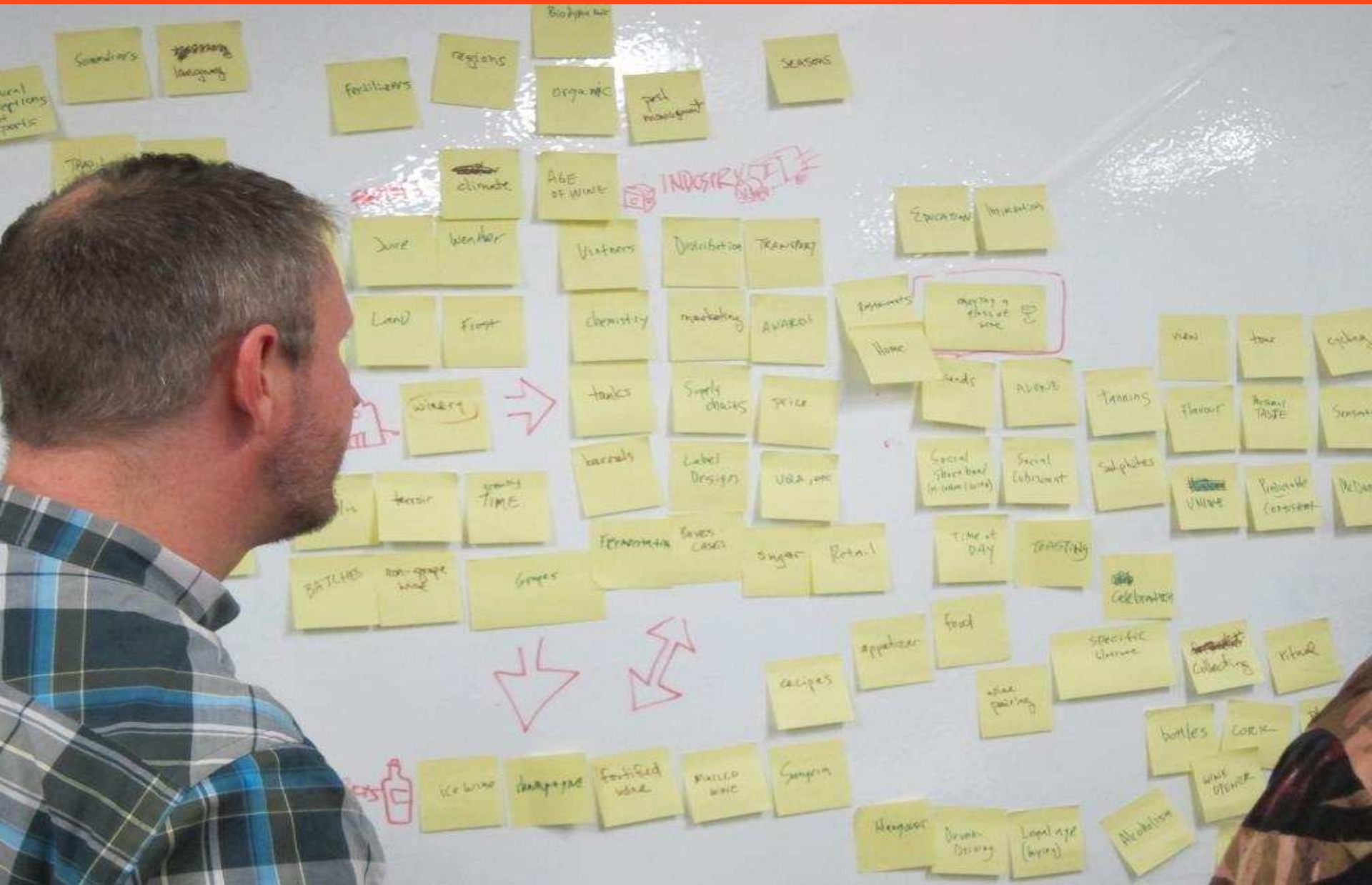
DESCRIPTIVE SYSTEMS METHODS And DESIGNERLY PRACTICES

*the use of **Interactive Sketching***



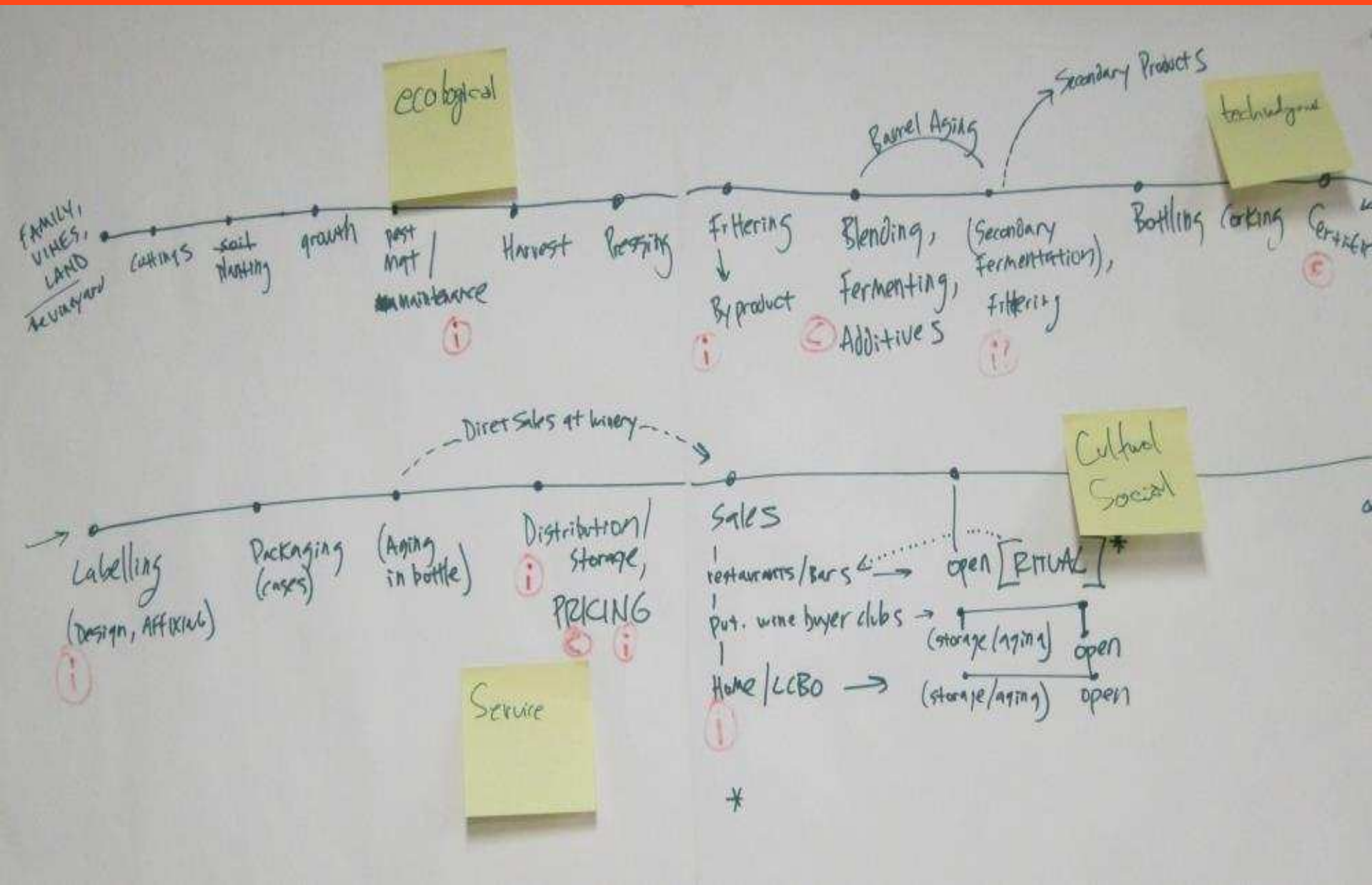
unpacking the problem aspects

highlighting connections for visualization



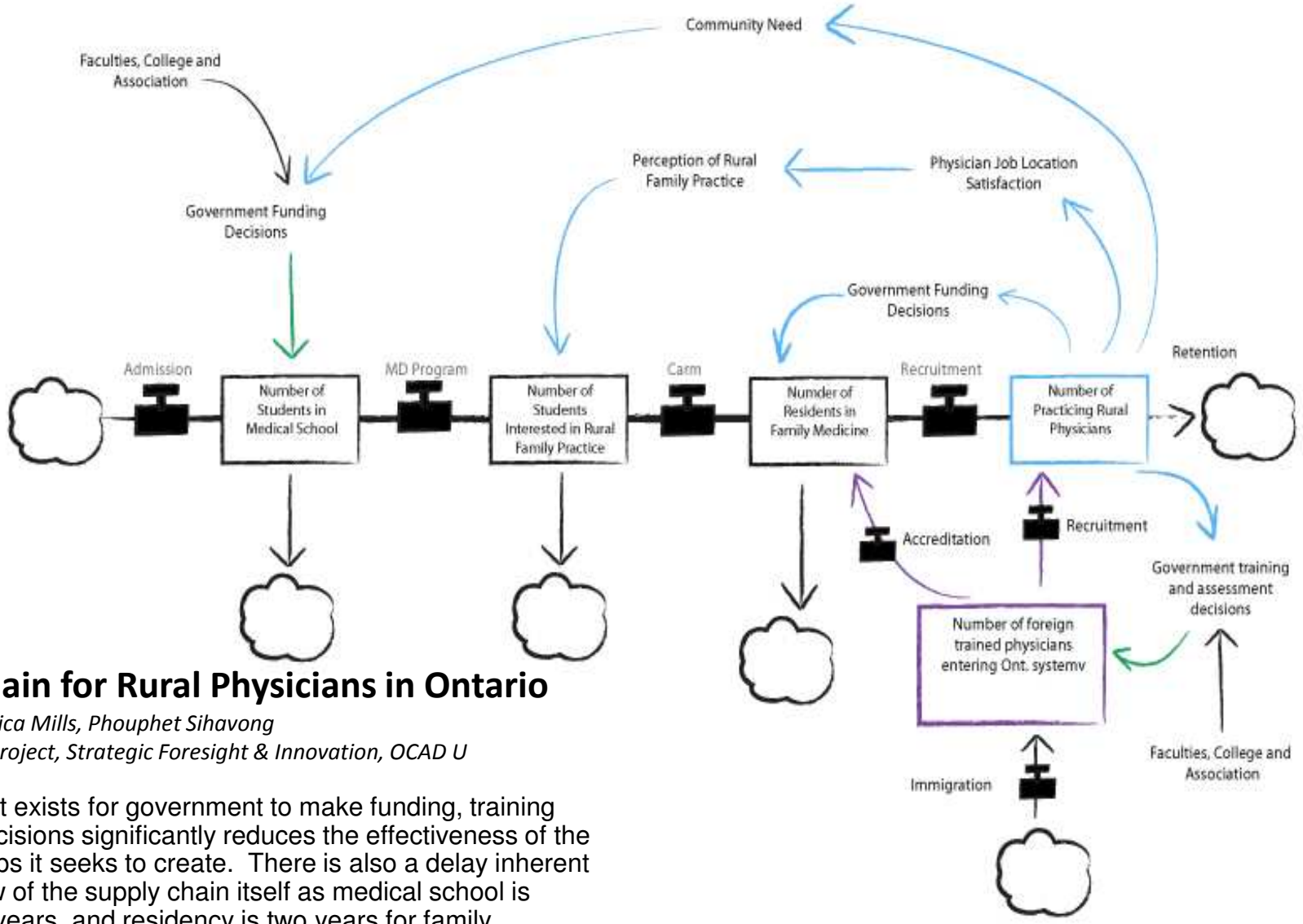

TV
HIGHTECH
SEDENTARITY
JUNK
WORK OUT
GYMS
CITY
BURBS
GROUNDED IN RESEARCH
INTUITION NEED TO RESEARCH
INNOVATION ?
ATTITUDE
POOR FOOD CHOICES
LOW INCOME
TIME PRESSURES
HOME COOKED MEALS
FRESH FOOD
FOOD POLICY
POLICY
LARGE DONATIONS
PSYCHOLOGY
UNSTABLE HOME ENVIRONMENT
ISOLATED
HOME EXERCISE
GYM ACTIVITIES
COUNSELLING
HEALTHY LIFESTYLES EDUCATION
HEALTHY FOOD CHOICES
COMMUNITY GARDENS
POOL

*Visualization of **PATTERNS** and **timelines***



*making sense through **visualization & critiques***

Visual Language of Flow & Feedback



Supply Chain for Rural Physicians in Ontario

Josina Vink, Jessica Mills, Phouphet Sihavong
Social Systems project, Strategic Foresight & Innovation, OCAD U

The delay that exists for government to make funding, training and policy decisions significantly reduces the effectiveness of the balancing loops it seeks to create. There is also a delay inherent within the flow of the supply chain itself as medical school is typically four years, and residency is two years for family medicine.

exploring ***Causal Loops*** *as a* ***Visual Language***

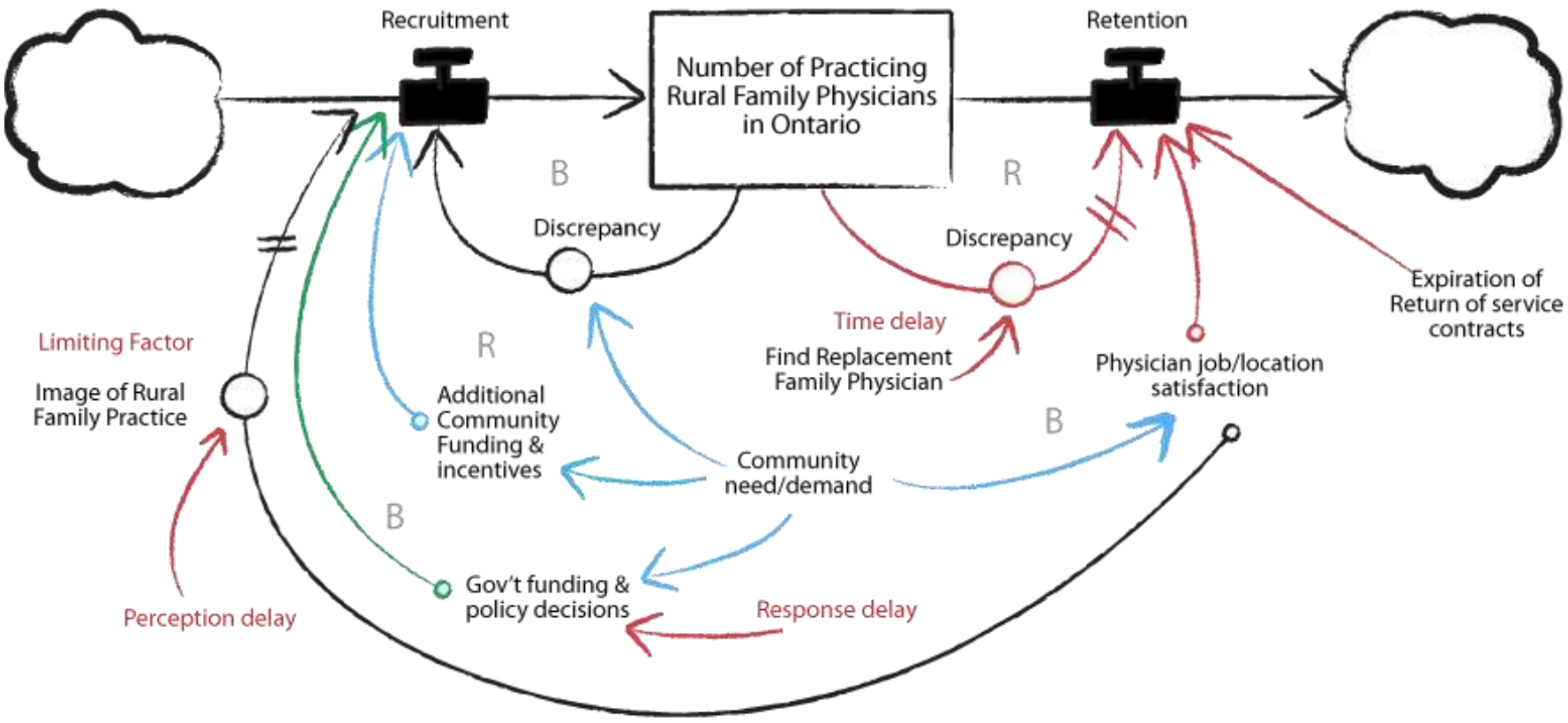
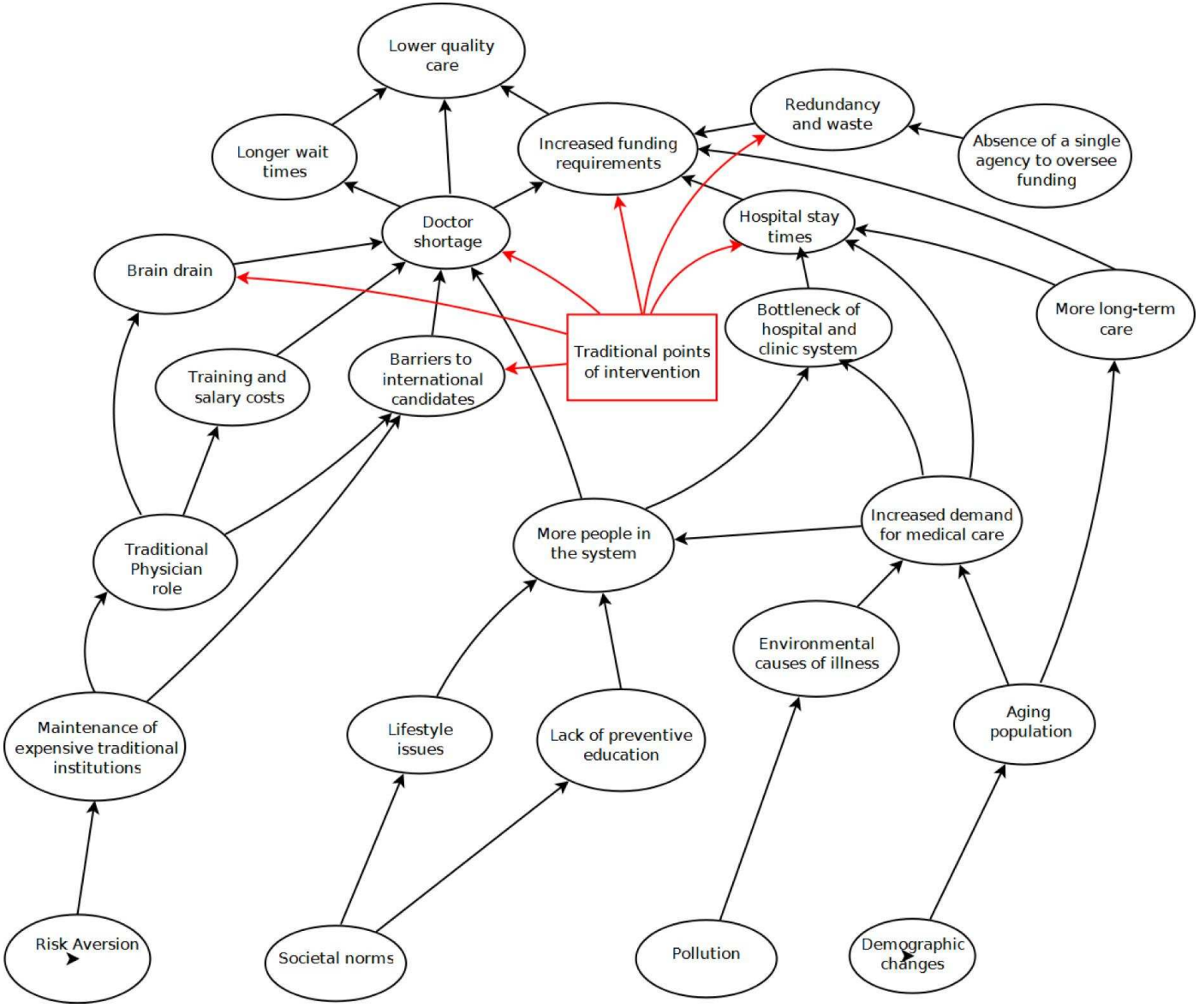


Diagram of Practicing Physicians in Ontario

Josina Vink, Jessica Mills, Phouphet Sihavong
Social Systems project, Strategic Foresight & Innovation, OCAD U

The average age of family physicians in Ontario is 52 years old.
9.8% of family physicians in Ontario practice in rural communities, where as 13% of Ontarians live in rural communities. One third of physicians in Canada practice family medicine, but to meet the need, it should be closer to one half of all physicians.

*Uncovering root causes and **Influence Mapping***

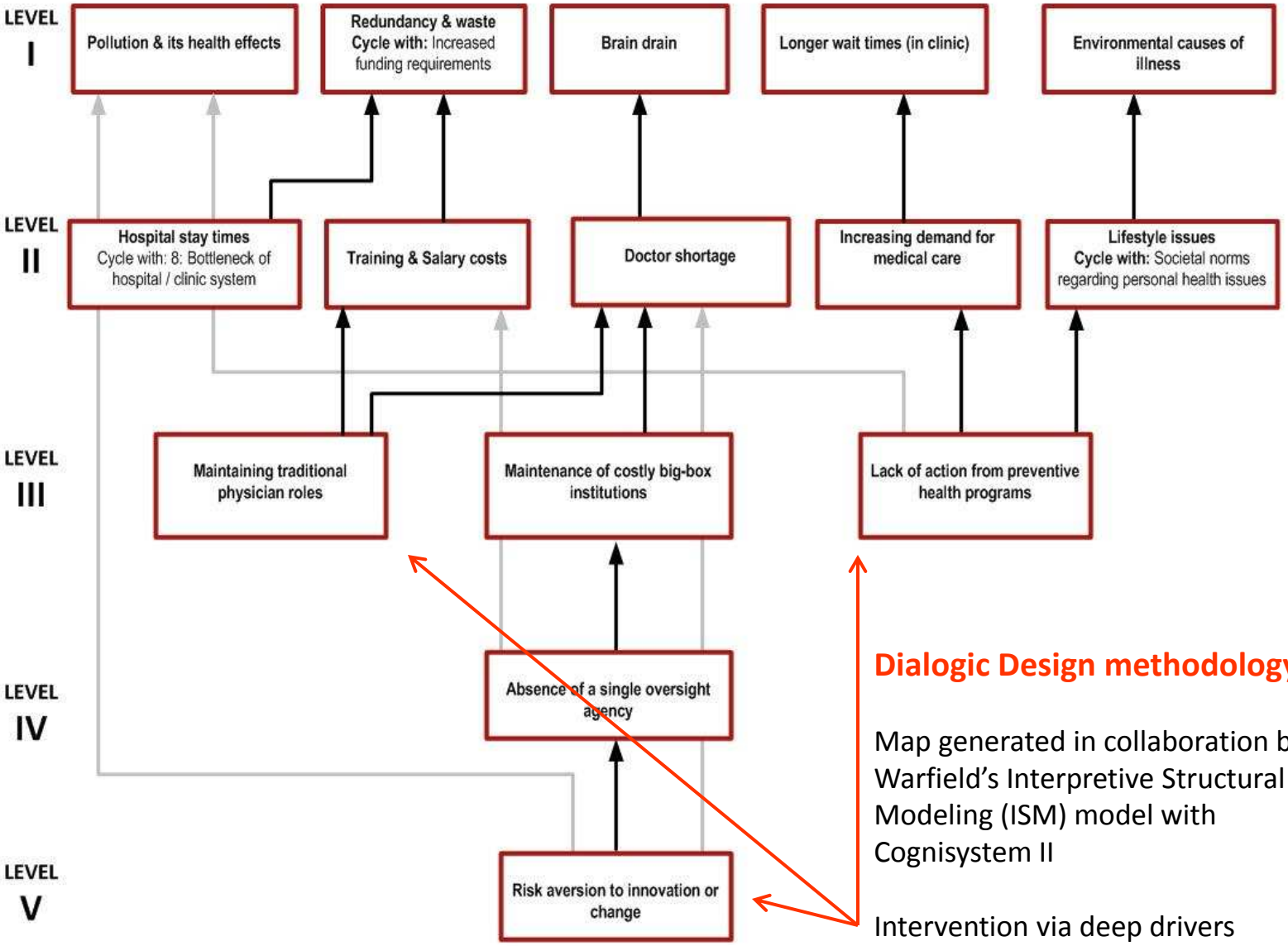


Healthy Healthcare

Oksana Kachur, Jonathan Resnick, Karl Schroeder, Social Systems project, Strategic Foresight & Innovation, OCAD U

What are the most significant issues affecting the quality of healthcare in Ontario? The outcome of this Interpretive Structural Modelling session was the influence map shown.

Influence Mapping and points of intervention

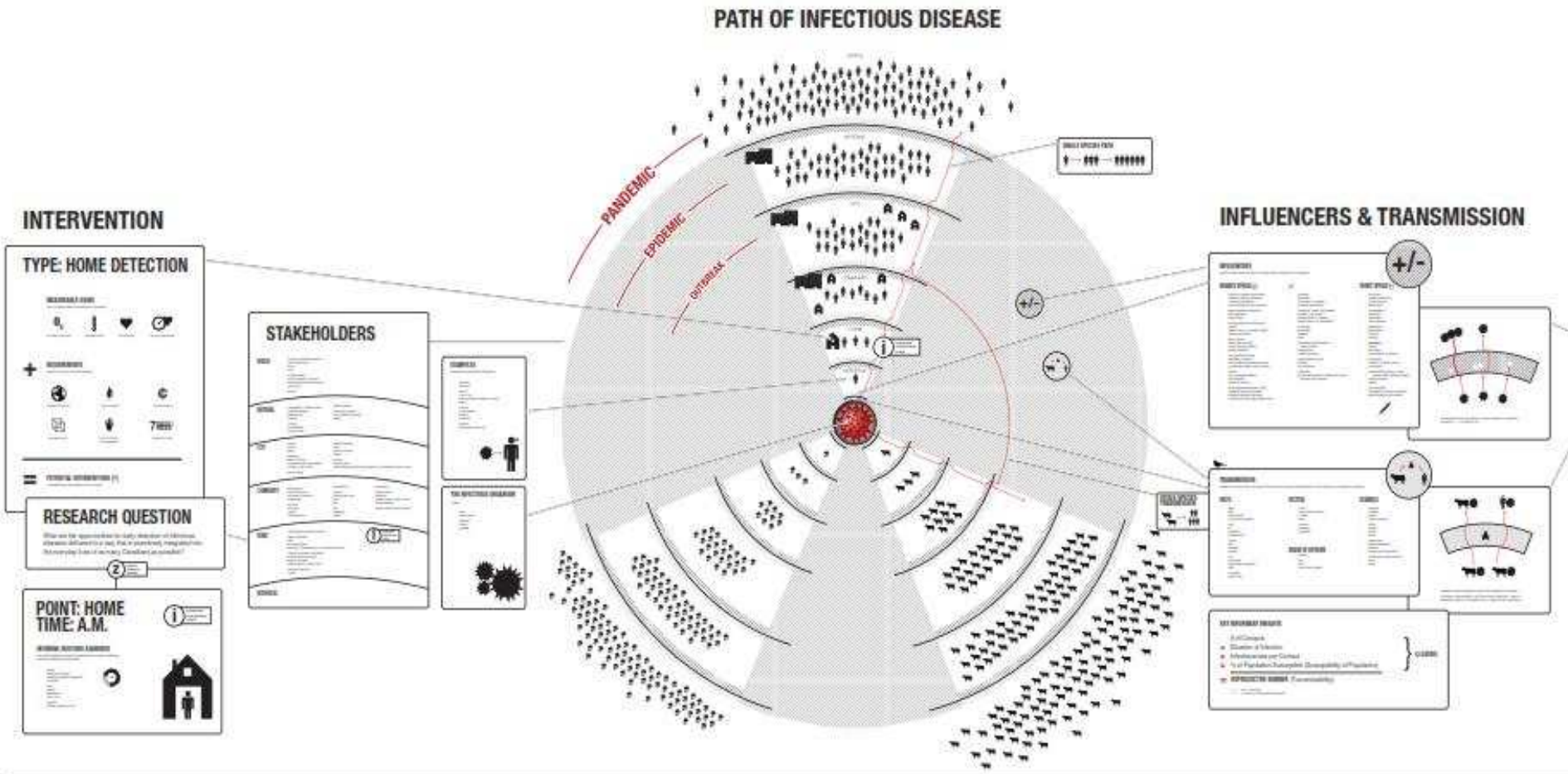


Dialogic Design methodology

Map generated in collaboration by Warfield's Interpretive Structural Modeling (ISM) model with Cognisystem II

Intervention via deep drivers

*the **GIGAMAP** as a visual synthesis*



AGE-RELATED OBESITY TRENDS AND FACTORS

Obesity rates: children 2 - 17 x3 in 25 years

20 → 28 (1/3 of normal BMI, 20 year olds) BMI→25+

20 → 28 (1/2 of high BMI, 20 year olds) BMI→25+

IF TREND CONTINUES, in 20 YEARS...

70% 35 -44 y.o. BMI→25+

BMI:

25→30 = overweight

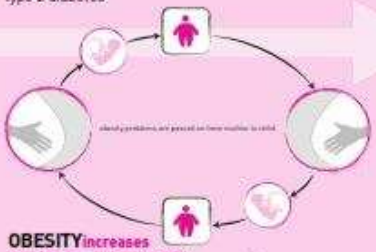
30+ = obese

Body Mass Index= $\frac{\text{mass(kg)}}{(\text{height[m]})^2}$

CRITICAL PERIOD

Prenatal

- children born to obese mothers are more likely to have weight problem compared to lean mothers
- children born to obese women with gestational diabetes may be programed in the womb to be overweight and prone to type 2 diabetes



OBESITY increases the risk for autism by 60%

- children born to obese women with gestational diabetes are more likely to give birth to a child with autism or other developmental problems.

when exposed to diabetes in the womb:

breastfed <6 months

- more fat around midsection
- greater BMI

when exposed to diabetes in the womb:

breastfed >6 months

- LESS fat around midsection
- lower BMI

Breastfeeding

- reduces infections in babies, boosts their immune system and prevents obesity

Solid foods

- introduction of solid foods earlier than 4 months is **associated with 6x higher risk of obesity**

6x HIGHER RISK

4 MONTHS NO SOLID FOOD

The US National Ambulatory Medical Care Survey (NAMCS) estimated **that obesity-related counseling occurred in only around 25% of visits** and the rates are declining.

ONLY 25% of Doctor office visits include obesity-related counseling

155 lb

135 lb @ 11, BMI>30

95 % : BMI 30+

50 % : BMI 18.9-24.9

emotional problems, bullying, discrimination, physical health problems

Adiposity rebound:

- body fatness normally declines to a minimum (at 5 - 6 years)

"early AR is associated with an increased risk of adult obesity independent of parent obesity and the BMI at AR"

At age11:

→46% of children of **obese moms** had a **BMI>25** compared with →12 % of children of **non-obese moms.**

Adolescence

- represents a period of increased risk for the development of obesity
- the period in which the location of body fat changes and may establish the subsequent risks associated with obesity.

At age 2, 8 and 11, far more children of obese mothers were overweight than children of non-obese moms...

-75 -12 0 1 2 3 4 5 6 7 8 9 10 11 12 ...

POSITIVE INTERVENTION PERIOD

Evidence indicates that early identification and referral for treatment during early childhood yields much greater success in treatment.

Two large-scale long-term observational studies of treatment programs that served children from 2 to 14 years of age recently demonstrated a **large-magnitude increase in long-term treatment efficacy** among obese children who were identified **and referred for treatment between 2 and 6 years of age compared with those with obesity identified and treated in later childhood.**

Obesity prevention and management recommendations for children involve **changes in parental behavior.**

"An adaptation of the 5 A's for obese patients includes assessment of patient health risk, assessment of current behavior and readiness to change, advising the patient to change specific behaviors, agreeing about the behaviors and collaboratively setting goals, assisting patients in addressing barriers and securing support, and arranging for follow-up."

5A's

training the obesity problem for patients

Assess
Advise
Assist
Address
Arrange

moderate speed (12 – 14 mph) biking use approximately 235 calories per 1/2 hour

e.g.: 6 days x 235 cal. x 25 weeks = 35, 250 cal. → just over 10lbs of calories burned

100 lb

50 % : BMI 18.9-24.9

P.JONES: SPIN 6886 - 2012 - PROJECT 2: KOMORI • READ • SHEWCHUK

1

Characterization

Understanding the purpose, functions, & behaviors of a (social) system

Design Languages for Systems Methods

*Implications for **PEDAGOGY***

Learning systems principles in a design context

Course in OCADU Strategic Foresight & Innovation MDes:

Understanding Systems & Systemic Design

Originally 2 courses: 6 modules, 2 projects

- Systems concepts
- Natural systems
- Social systems & service systems
- Social systems & design methods
- Structured dialogic design

Rheinfrank, J. and Evenson, S.
From Winograd, Terry. 1996. *Bringing design to software*. New York: Addison-Wesley.

*Implications for **PEDAGOGY***

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Gharajedaghi & Meadows texts
Iterative system mapping
Small team map & analysis
Gigamapping
Global problematique

+ **Depth readings**
Ostrom, Hollings
Rittel, Buchanan
Beer, Spohrer, Warfield
Christakis, Ozbekhan

Build on a base of design thinking.
Visual language integrated throughout, required with every project.
Builds base for systemic design for foresight-led innovation.

IMAGINATION IS EVERYTHING
OCAD U

Thanks.

Peter Jones, PhD **@redesign**
OCAD University

Jeremy Bowes
Professor, OCAD University

Strategic Innovation Lab **sLab.ocadu.ca**